Ontario Geological Survey

Northern Ontario
Engineering Geology Terrain Study 102

MATTAWA AREA

(NTS 31L/SE)

District of Nipissing and County of Renfrew

by

John F. Gartner and D.F. VanDINE

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MAP
(accompanying report)

Map 5042 (coloured) – Northern Ontario Engineering Geology Terrain Study, Data Base Map, Mattawa (NTS 31L/SE). Scale 1:100 000.

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1.0 INTRODUCTION

This report contains an inventory of regional engineering terrain conditions in the Mattawa area, Districts of Nipissing and County of Renfrew. The area, which covers NTS block 31L/SE, lies between Latitude 46°00'N and the Ottawa River and Longitudes 78°00'W and 79°00'W, thus taking in the northern portion of Algonquin Provincial Park. It forms part of a series of publications which provide similar terrain data for some 37 000 km^2 of northern Ontario.

The purpose of the mapping is to provide a guide for engineering and

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resource planning functions at a level of detail consistent with a scale of 1:100 000. The terrain information is contained on the Data Base Map (OGS Map 5042, accompanying this report).

Interpretation of existing black and white aerial photographs, at a scale of approximately 1:38 000, was the primary method of obtaining this terrain information. The interpretation was checked with published and unpublished literature which documented previous field visits and observations. During the fall of 1977, roads in the area were traversed and observed terrain conditions recorded as further verification of the office studies. Thus, the map represents a reconnaissance overview of the engineering conditions of the terrain.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. Further information on the mapping techniques, legend format, and possible uses of this terrain data is available in the "Ontario Engineering Geology Terrain Study Users' Manual" (Gartner, Mollard and Roed 1980), a companion publication to this series of maps and reports.

2.0 GEOLOGICAL SETTING:

2.1 BEDROCK:

Precambrian rocks of the Grenville Structural Province underlie the Mattawa map-area. These rocks have a long and complex geological history covering at least 2 500 million years (Lumbers 1971). They have been strongly metamorphosed, folded, and then intruded by igneous rocks.

The oldest and most abundant rocks of the metamorphic complex are metasediments derived largely from siliceous sandstones and siltstones. These metasediments consist of a variety of gneisses and can be found throughout most of the map-area.

Stocks, sheets, and batholiths of felsic igneous rocks were emplaced within the metasediments and were themselves metamorphosed to gneiss and migmatite. These intrusive rocks occur as small bodies scattered through-

out the map-area, but occurrences are larger and more abundant in the western half.

Occurrences of iron, titanium, and euxinite in the west-central part of the area give it a medium mineral potential. Several occurrences of mica in the south-central part give it a medium potential for this commodity. The remainder of the map-area has low mineral potential (Springer 1978).

2.2 QUATERNARY:

Glacial ice advanced toward the south and southwest, (Boissonneau 1968), depositing a discontinuous veneer of ground moraine till over the bedrock. During deglaciation, approximately 10 000 to 12 000 years ago (Harrison 1972), a number of glaciofluvial deposits were formed (Chapman 1975). These deposits, which are shown on the Data Base Map (OGS Map 5042, accompanying this report) as kames, eskers, and outwash, occur mainly in Clara and Cameron Townships.

The portion of the map-area lying immediately south of the Mattawa River was inundated by proglacial lakes. As a result, glaciolacustrine sediments can be found below elevations of 260 to 275 m. These sediments occur along the lowlands bordering the Mattawa and Ottawa Rivers. The Quaternary deposits found in the map-area are quite complex, having resulted from a variety of geological processes associated with glacial, glaciofluvial, and glaciolacustrine conditions. The user is advised to refer to Harrison (1972) and Chapman (1975) for further discussions on the glacial history.

3.0 ENGINEERING TERRAIN UNITS:

3.1 BEDROCK LANDFORMS:

3.1.1 Description:

Rock knob (RN) terrain dominates the map-area. North of the Mattawa River, local relief is generally high, with bedrock hills often exceeding 60 m in height. Complex and steep slopes are common. Throughout the remainder of the area, relief is generally less than 60 m, but slopes are

still complex and steep. Drift cover is thin (less than 1 m) and bare bedrock is common. The overburden becomes thicker on the flanks of some of the bedrock hills. Local till thicknesses reach 5 to 10 m in several areas along and north of the Mattawa River in the northwestern part of the area and along Highway 17 south of the Ottawa River.

Organic terrain commonly occurs between bedrock hills as a subordinate landform within rock knob terrain. Typical terrain unit letter codes are:

$$\frac{\text{RN(tMG, pOT/R)}}{\text{Hj-D(M)}} \qquad \frac{\text{RN(tMG, pOT/R)}}{\text{Mu-D(M)}}$$

3.1.2 Significance:

RESOURCES: Portions of the rock can be used for crushed stone purposes, but detailed evaluations of suitability for aggregate use would be required. Ground water resources within the bedrock will be limited to fractures, faults, and fissures. The occurrence of aquifers is unpredictable and the terrain has poor potential for ground water supplies.

GENERAL CONSTRUCTION: The major constraints in terms of construction are the bedrock outcrops, the occurrence of large boulders on surface and the organic terrain that is often associated with the bedrock. This means that, in most instances, excavations will require blasting. Site-grading will be expensive and rock fills will be necessary in grading works. Foundation conditions should be excellent on the bedrock, but route alignments will require rock cut-and-fill operations.

Management of the land for any development will be complex. The steep and variable bedrock slopes, combined with the shallow overburden, make the terrain susceptible to surface erosion, especially when cleared of vegetation.

WASTE DISPOSAL: The bedrock terrain is not amenable, in its natural state, to the disposal of waste, whether it be garbage, septic tank effluent, or industrial liquids. Development of lagoons or tile fields will require grading of rock materials and, very often, the importation of soil fill. Fractures in the bedrock could act as conduits for migration of effluents, and the pollution impact on surface drainage courses could be significant.

3.2 MORAINAL LANDFORMS:

3.2.1 Description:

Ground moraine (MG) occurs as a subordinate landform in rock knob terrain throughout most of the map-area. It also occurs as the dominant landform in 1) northwestern Cameron Township in the north-central part of the map-area and 2) northern Fitzgerald Township in the south-western part.

In both of these areas, the ground moraine consists of bouldery silty sand till. In Cameron Township, the bedrock is never more than a few metres from surface, as indicated by the letter code:

$$\frac{\text{tMG(RN, pOT)/R}}{\text{Mu-M}}$$

The ground moraine appears to be thicker in Fitzgerald Township, and linear ice flow features have been identified along the northern edge of the deposit. The letter code for this unit is:

$$\frac{\text{tMG(pOT, RN)}}{\text{Mu-M}}$$

3.2.2 Significance:

RESOURCES: Ground moraine is a poor landform in which to find deposits of sand and gravel. At best, only small pockets of suitable material can be expected. However, local surface deposits of sand and gravel may occur where the ground moraine has been modified by meltwaters or glaciolacustrine action. Ground water resources are expected to be significant only where the ground moraine has a substantial thickness and overlies permeable sand and gravel at depth. Such a situation can be identified only through more detailed studies.

GENERAL CONSTRUCTION: Because ground moraine till is bouldery and often forms only a thin blanket over the bedrock, there will be a number of construction problems associated with rock excavation and grading. Excavations, except for shallow ones, will likely intersect bedrock and zones of very bouldery soils. On the other hand, the proximity

of bedrock means that bearing capacities for foundations will generally be excellent.

WASTE DISPOSAL: The bouldery nature of the till and the existence of near-surface bedrock place constraints on the siting of waste disposal facilities. Septic systems are probably feasible, but site-specific investigations will be required to ascertain bedrock levels, slope conditions, and the proportion of boulders in the till. Determination of the thickness and hydrogeologic characteristics of the morainal till and the surrounding environment is important when assessing these terrain units for solid or liquid waste disposal schemes.

3.3 GLACIOFLUVIAL LANDFORMS:

3.3.1 Description:

Outwash (GO) deposits, which are scattered throughout the Mattawa map-area, are grouped according to their location.

NORTH OF MATTAWA RIVER: Outwash materials are found along Highway 533 from the Town of Mattawa northwest into Antoine Township in the northwest corner of the map-area. In some areas, the outwash consists of well-bedded sand and gravel (Harding 1944), while in others there is a predominance of sand. The material has generally been deposited in low areas adjacent to creeks and is associated with alluvial plains. In some units, bedrock is close to surface. Typical letter codes are:

$$\frac{\text{sgGO}}{\text{Mu-D}} \qquad \frac{\text{sgGO}}{\text{Lk-Dh}} \qquad \frac{\text{gsGO(sgAP)}}{\text{Lp-D(Dh)}} \qquad \frac{\text{sgbGO(pOT)/R}}{\text{Lun-M}}$$

TOWN OF MATTAWA: The town is underlain by gravelly sand outwash materials which provide a level and well-drained townsite. The Mattawa River passes through the town and a subordinate alluvial plain landform, resulting from deposition by the river, is included in the unit. The letter code is:

$$\frac{\text{sgGO(sgAP)}}{\text{Lu-Dh}}$$

PAPINEAU TOWNSHIP: A large area of outwash covers the southeastern portion of this township. The deposit appears to contain both sand and gravel, and is associated with an esker ridge near its northern limit. Bedrock is often close to the surface and affects the topographic relief of the landform. The letter code is:

$$\frac{\text{sgGO/R}}{\text{Mu-M}}$$

CLARA TOWNSHIP: Outwash is associated with kames and eskers in the western part of the township. The unit consists basically of sand with minor gravel, but pockets of coarse material probably exist. Typical letter symbols are:

$$\frac{\text{sgGO(sgGE)}}{\text{Mu(r)-Dh(D)}} \qquad \frac{\text{sgGO}}{\text{Mu-M}} \qquad \frac{\text{sgGO}}{\text{Lp-D}}$$

WHITE TOWNSHIP: This township, located in the southeast corner of the map-area, has an extensive deposit of sandy outwash which is associated with organic terrain. This deposit correlates with the large spillway to the east and south identified by Chapman (1975). The letter code is:

$$\frac{\text{sgGO(pOT)}}{\text{Muk-M}}$$

Eskers (GE, <<<<<) trend in a southerly direction, the largest being the landforms in the northwest corner of the map-area and south of Deux Rivières in the eastern part. Other isolated esker ridges are scattered throughout the area.

The esker in the northwest corner of the area is associated with flanking outwash deposits and the material can be locally coarse. The terrain unit letter code is:

$$\frac{\text{gsGE}}{\text{Mr-D}}$$

Chapman (1975) describes the esker south of Deux Rivières as the largest in the region. It is 0.8 km wide, 3 m high and has a level top. The esker consists mainly of fine sand with very little gravel.

Kames (GK) are also found within the Mattawa map-area. They are closely associated with the esker at Deux Rivières, as indicated by the complex letter code:

$$\frac{\text{sgGK(sgGE)}}{\text{Mu(r)-D}}$$

South of the village of Klock in northern Cameron Township, Chapman (1975) mapped kames which he described as part of a recessional moraine. This landform is represented by the letter code:

$$\frac{\text{sgGK}}{\text{Mu-D}}$$

An *ice contact delta* (GD) occurs south of Holden Lake on the Ottawa River, near the eastern boundary of the map-area. A 10 m pit face indicates that the deposit consists of stratified medium and fine sand with minor gravel. The landform is generally planar and terraced. The terrain unit letter code is:

$$\frac{\text{sgGD}}{\text{Mpt-D}}$$

3.3.2 Significance:

RESOURCES: The glaciofluvial deposits are good areas in which to search for sand and gravel resources. Units consisting of sandy gravel (gs) or gravelly sand (sg) are particularly good prospects. Such deposits occur north of the Mattawa River and in association with other landforms throughout the entire map-area.

The larger and deeper outwash deposits have good potential for the discovery of ground water supplies. Harrison (1972), suggested the possibility of a large, untapped source of ground water beneath the Town of Mattawa.

GENERAL CONSTRUCTION: The materials which comprise these glaciofluvial landforms are generally granular in nature and exhibit good engineering characteristics. However, the following local conditions can cause construction difficulties:

1) areas of potentially high water tables,
2) near-surface bedrock,
3) steep and complex slopes in the kame units, and
4) the existence of surface and buried boulders.

The terrain unit letter codes should be studied to determine whether such local conditions might exist in the area of interest.

WASTE DISPOSAL: Because of the permeable nature of the materials and the possibility of connections between ground water and surface water, the disposal of liquid and solid wastes within glaciofluvial landforms must be approached with considerable caution. Detailed hydrogeological investigations are required to determine potential contaminant flow characteristics.

3.4 GLACIOLACUSTRINE LANDFORMS:

3.4.1 Description:

Glaciolacustrine plains (LP) occur below elevations of 260 to 275 m, immediately south of the Mattawa and Ottawa Rivers. A typical terrain unit letter code is:

$$\frac{\text{mcLP/R(R)}}{\text{Mu-D}}$$

This indicates that the landform consists of clayey silt and often overlie bedrock. The terrain is undulating and surface drainage conditions are dry.

3.4.2 Significance:

RESOURCES: Terrain underlain by the glaciolacustrine deposits is usually cultivated or in pasture. Other than this, the glaciolacustrine units have little resource potential.

GENERAL CONSTRUCTION: Construction conditions within the glaciolacustrine landforms are only rated as poor to fair. The low relief and planar topography produces poor surface drainage in many places. The fine-grained texture of the soils (i.e. silt and clay) causes problems

related to earth handling, compaction, and frost susceptibility. Due to the poor geotechnical characteristics of the clay and silt, bearing capacity for foundations may be a problem, especially where there are substantial thicknesses of glaciolacustrine sediments.

WASTE DISPOSAL: Glaciolacustrine landforms are not always suitable for waste disposal schemes. The impermeable nature of the silt and clay impedes the proper functioning of tile beds. Sanitary landfill facilities must be specially designed to avoid contamination of the surface water, and cover materials are often difficult to handle.

3.5 ORGANIC AND ALLUVIAL LANDFORMS:

3.5.1 Description:

Organic terrain (OT) is found throughout the map-area as a common subordinate landform within the rock knob terrain. However, only the larger deposits have been shown as separate terrain units on the Data Base Map (OGS Map 5042, accompanying this report).

The organic materials can occur in association with outwash, lake plain, alluvial plain, ground moraine, or bedrock landforms, as indicated by the letter codes:

$$\frac{\text{pOT(sgGO)}}{\text{Mu-W}} \qquad \frac{\text{pOT(smAP)}}{\text{Lp-W}} \qquad \frac{\text{pOT(RN)}}{\text{Lp-W}}$$

More commonly though, the organic terrain occurs as a deeper deposit, shown as:

$$\frac{\text{pOT}}{\text{Lp-W}}$$

Alluvial plains (AP) are associated with most drainage courses, but only the larger ones have been shown on the Data Base Map. An example is the alluvial plain of Deux Rivières Creek, represented by the letter code:

$$\frac{\text{smAP(pOT)}}{\text{Lp-Dh(W)}}$$

3.5.2 Significance:

Both the organic terrain and the alluvial plains have very poor engineering properties and should be avoided by human activities. They are prone to flooding, can contain soft and compressible soils, and are generally unsuitable for any type of development.

4.0 SUMMARY OF ENGINEERING SIGNIFICANCE:

The preceding section described the characteristics of the major landform types and their engineering and resource significance. Table 1 is a summary of the general engineering significance of the more common terrain units found in the area. This table is intended only as a guide to help the reader in assessing the overall significance of the map-units. Site-specific work is necessary to better define actual ground conditions, such as drainage and slope, which are not considered in the table, but which may affect the engineering significance of the various terrain units.

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TABLE 1: SUMMARY OF ENGINEERING SIGNIFICANCE

		BEDROCK	MORAINAL	GLACIOFLUVIAL			GLACIO-LACUSTRINE	ORGANIC
		RN(tMG, pOT/R) / Mu-D(M)	tMG(pOT, RN) / Mu-M	sgGO	sgGE	GK	LP	OT
RESOURCE POTENTIAL	SAND & GRAVEL	Poor	Poor	Excellent	Excellent	Good	Poor	N/A
	GROUND WATER	Poor	Poor	Good	Fair	Fair	Poor	Poor
LIGHT CONSTRUCTION CONDITIONS	EXCAVATIONS	Blasting	Fair to Poor	Excellent	Good	Fair	Good	Poor
	FOUNDATIONS	Excellent	Good	Good	Good	Good	Fair to Poor	Very Poor
	GRADING	Difficult	Fair	Good	Good	Fair	Good	Very Poor
	MATERIAL RE-USE	Rockfill	Fair to Good	Excellent	Excellent	Good	Fair to Poor	Very Poor
WASTE DISPOSAL SUITABILITY	SEPTIC SYSTEMS	Very Poor	Fair	Good	Fair	Fair	Fair to Poor	Very Poor
	LANDFILL	Very Poor	Fair	Poor	Poor	Poor	Fair	Very Poor
	LAGOONS	Very Poor	Fair to Good	Fair	Fair	Fair	Good	Very Poor

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